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⁂ *The above List is prepared from the Patent Records by Mr. T. Morgan, Secretary of the Inventors' Patentright Association, Limited.*

Reviews.

A PLEA FOR RE-INCARNATION.

"A Plea for Re-Incarnation," By Francesca Arundale,

This is a clever and logical pamphlet on the most interesting subject of a belief which has occupied the minds of many earnest thinkers from Plato downwards, and which if once generally accepted would, perhaps, revolutionize many religions of the present day. That there are cogent arguments in favour of this theory not unsupported by the Christian and other faiths, interlinking the various stages in the progress of humanity, is doubtless true. The subtle arguments here brought forward are worthy of notice, and must at least influence the minds of those who are disposed to exercise a judicious power of reasoning in a natural sense. It must be patent to a mind even of average intelligence that *one* life in this planetary world, with its indefinite experiences, affords but a mean passage to the accomplishment of the great divine purpose of life. If our crosses and wrongs which we rarely have the opportunity of repairing, being sometimes powerless to act and redress, are not retrieved in this one life, it is natural to suppose that justice affords the possibility of redemption somewhere; and if not again in physical life, where then is the hope? The writer has grasped this subject in a masterly manner, but our space not permitting us to follow it further, we recommend its perusal to our readers.

SONNET.

On viewing the picture of "Sappho," by Madame de Steiger.

Daughter of Eresos, mistress of the Muse!
Who, sibyl-like, shone o'er the world of yore
And sang thy matchless odes on Lesbos' shore;
Wafting thy mystic music to infuse
The soul of Phaon! As the summer dews
That steal o'er nature's breath at twilight hour;
Instilling life and love to fruit and flower,
So thy sweet lyre and song thine ilse suffuse!

Though those mayst sleep! thy gentle spirit still
Inspires in Aphrodite sons of earth.
As Ovid sang, and Solon woke thy birth,
Fain would we now our souls with rapture fill.
And while, in pictured art, on thee we gaze,
Muse o'er the glory of those ancient days!

Henry George Hellon.

ANNAMITE LITERATURE AND SUPERSTITIONS.

Although the circumstance that he has written only in French or in Quoc-ngu has prevented the works of P. Troung-Vinh-Ky, the well-known Annamese savant, from being widely appreciated in this country, Annan has its poems and popular songs, and songs satirical, sentimental, and proverbial. It is conceded, says Mr. Tremlett, that previous to the Chinese conquest, B.C. 110, the Annamites had a distinct literature and written characters, but during the following 1500 years these for the most part disappeared. The Annamese language is monosyllabic, and has no pretension to grammatical construction; one word has often many meanings distinguished by inflection, the language contains many Chinese words, and since the recent war French and Spanish also; the literati, too, are fond of concocting words, so that altogether the language is anything but attractive to the ordinary student.

Turning to Annamese superstitions, Mr. Tremlett gives some interesting details concerning the method of conducting funerals in Annam. It appears that the respect with which the Annamese treat their dead gives to this ceremony considerable importance; as its numerous rites are not written law they are easily neglected to the prejudice of and danger to the family; the ceremony naturally varies according to the position the deceased held in the family, and the wealth of the mourners. The method of determining death is by means of a flake of cotton which the least breath would move; when death is assured the visage is covered with three leaves, ordinary paper, a red handkerchief covering all. This operation is called "dap mat," and it is an imprecation in general use to wish an enemy so poor that this expense cannot be afforded him; next three grains of rice are placed in the mouth of the deceased, three bowls of cooked rice are arranged in half circle about the head, and two candles placed there; from the moment of death a relative is put in charge of the body to see that no cat passes over it, for it is the cat that seeks to steal the soul. Coffins are often ready years in advance, and are made of valuable woods that remain intact for a long while; they may easily cost £40. The laying out is usually done by a stranger.

If any member of the family happens to have been born immediately after the deceased he must leave the house for fear of contagion of death. The body is bathed in perfumed water, dressed in its best clothes and a black turban; nails are cut and deposited about the head. When the various bandages are in order, a favourable hour is awaited, which must not be the hour of birth of any near relative, then the body is placed in the coffin, this is placed in the centre of the house for a father or mother, but at the sides for a son or daughter; various offerings are exposed and renewed at the usual hours for meals; three days afterwards the coffin is varnished to prevent the attacks of white ants; mourning habits are of unbleached and unhemmed cotton of native manufacture; various inscriptions are placed upon the doors and a lantern with blue characters hung in front; these are allowed to remain until they decay, but are not renewed.

The coffin remains in the house sometimes for three months, during which time the eldest son sleeps at its foot upon the ground. Should the wife of the heritor during the period of mourning (two or three years) become enciente, the relatives may demand her condemnation for impiety. Order of procession: two lanterns, a banner of silk or paper, a sheet of white silk suspended between two poles representing a door, gongs, table with candles and other offerings, gong, model of a house, lanterns, the bier, lanterns, tables of offerings. The coffin is sometimes placed in and sometimes above the ground; the tombs are of all sizes and stages of ornamentation, and are of various forms—those of priests are pyramidal.

The coffin once deposited in the tomb, the relatives and friends throw a handful of earth over it, verses being recited by the usual paid mourners: then the relatives salute the friends who have assisted, and offer them wine and betel; an altar is placed before the tomb with offerings; a tablet is put in place with the name and titles of the deceased.

CANADIAN APATITE.

THE numerous openings made by prospectors and miners in the phosphate regions of the provinces of Ontario and Quebec have afforded excellent opportunities for the study of the Laurentian minerals and their mode of occurrence. The crystalline limestone of the Laurentian series are remarkable for their great extent and for the variety of crystalline minerals which they contain. They are interstratified with beds of dolomite, which sometimes contain a portion of carbonate of iron, and inclose serpentine, tremolite, quartzite, and a little white mica, but are generally less abounding in foreign minerals than the pure limestones. Several mineral species might be mentioned as marking bands in the stratification. Among these there are apatite, chondrodite, pyroxene, magnesian mica, and graphite. Apatite or phosphate of lime is one of the principal features of the limestones of the Laurentian series. It is found in a variety of colours and shapes, sometimes in rare crystals disseminated throughout the veins; at others, in solid masses, in veins of great width. Sometimes it is in the form of prisms. These are generally rough, but often terminated and always have their angles rounded. Apatite is generally associated with pyroxene which has also been found in large crystals. It is sometimes found with phlogopite. In a crystal of the latter, about four inches in diameter, a crystal of apatite about a quarter of an inch thick and two inches long was found imbedded, the axis of the prism being parallel with the cleavage of the mica. Rounded masses of calcite are often inclosed in the apatite, which in its turn is frequently in rounded pale green crystalline masses embedded in the coarse-grained limestone.

Apatite is used in the arts for the manufacture of phosphoric acid and phosphorus, and enters largely into the composition of certain porcelains. It is, besides, very extensively used as a fetilizer of the soil. Phosphates are among the minerals most essential to vegetation, and are removed from the earth in large quantities by growing crops, The importance of a supply of phosphates to the soil is made very evident by the fact that the mineral constituent of the bones of animals is for the greater part phosphate of lime. This material, whether in the form of bones, coprolites, or apatite, is seldom applied to the soil in its insoluble state, as it is then comparatively unavailable for the nutrition of plants. To render it fit for agricultural purposes, it is converted into a soluble salt, which is known as a superphosphate of lime. The process of conversion is as follows; In the insoluble mineral or bone phosphate, one equivalent or 71 parts of phosphoric acid is united to 3 equivalents of 28 parts each of lime, making the equivalent weight of the ordinary phosphate of lime 155. In order to reduce this to the soluble superphosphate, which contains one equivalent of phosphoric acid and one of lime, it is necessary to remove two-thirds of the lime, or two equivalents. This is effected by adding two equivalents, or 98 parts of sulphuric acid, which form with this lime 136 parts of sulphate. One hundred parts of ordinary phosphate of lime, therefore, require 63·2 parts of sulphuric acid to convert them into the soluble superphosphate with one equivalent of base. In this process, however, regard must be had to the foreign matters which accompany the phosphate, and which may also require sulphuric acid for their decomposition. Of these, the principal are fluoride of calcium and carbonate of lime. The former is always present in small quantities in bones, and in still larger amounts in many of the mineral phosphates, and requires for decomposition of 100 parts, 126 of sulphuric acid, while carbonate of lime, as an impurity, requires 98 parts of acid to decompose 100 parts.

Of late years the increasing demand for phosphates as fertilizers has drawn attention to the use of the crystalline mineral phosphate of lime, or apatite, of which large quantities have been imported from Norway into England, and attention has recently been turned to the abundant supplies of this substance found in Canada, and large importations have recently been made from the Canadian phosphate region into England. The present price for apatite in England is one shilling and five pence per unit, or about 30 dols. per ton, for a first-class grade. Capital is slowly investing in the phosphate lands of Canada. Railroad enterprise is moving for the purpose of transportation, and the time is drawing near when the mining or quarrying of phosphates will be one of the largest and best paying industries in Canada. The cost of production being small, but very little capital is necessary, and the large and continued demand fixes the price for which the mineral can be sold at such a figure that, as a profitable undertaking, not a doubt remains.

THE WRINKLING STRAIN OF PILLARS.

IT is not often that pillars are made of thin plate iron; but as the failure of pillars of this kind is analogous to that of plate girders, the student of construction may profitably consider the question of wrinkling strain. A plate iron pillar may fail in one of three ways: (1) by crushing, (2) by flexure, and (3) by wrinkling, each of these modes being governed by laws peculiar to itself. It is seldom that a pillar fails by crushing, as it is generally made of a proportion in which simple compression does not come into play. More generally a pillar yields by both bending and crushing, but in plate iron pillars failure may take place first by wrinkling or corrugation. A pillar made of wrought iron plates of a size that would prevent failure by flexure ought to have the plates of sufficient thickness to prevent wrinkling. Let us imagine a stanchion of [section formed by plates. It is readily conceived that the unsupported edges would wrinkle. It is found by experiment that the edges of such a section would fail by wrinkling unless the distance of the unsupported edges is small.

Mr. T. Box, in his treatise on "Strength of Materials," illustrates this strain by an example of a rectangular pillar of thin wrought iron plates both ends flat, 8·1 inches × 4·1 inches external dimensions, with a thickness of 0·061, and a length of 2⅓ feet. By calculation, this pillar would fail with 1,173 tons, or 766 tons per square inch. But the absolute crushing weight of wrought iron in pillars is only 19 tons per square inch, or one-fortieth of the theoretical breaking weight by flexure. Even this reduced strain was not borne by the pillar, as it actually failed by wrinkling with 7,108 tons per square inch, or little more than one-third of the crushing strain; the ratios of the strains being, by wrinkling 1·0, by crushing 2·7, and by flexure 108. The actual breaking load in this case was only 1-108th of the bending strength. By increasing the length of the pillar, flexure may become the principal source of weakness, its resistance to that being so reduced until it became less than the wrinkling strain. It often happens in practice that a pillar gives way partly by flexure and partly by wrinkling—a mixed result being obtained. Thus in studying the laws of wrinkling strain, the experiments are made on short pillars, where flexure cannot come into play.

Mr. Hodgkinson's experiments may be expressed by the following rule for the compressive strain in tons per square inch, with which the plate will wrinkle.

$$W = \sqrt{t \div b} \times M,$$

where W = the compressive strain in tons per square inch, t = the thickness of the plate in inches, and b the breadth in inches of a plate supported at both edges, as in a square pillar: M = the multiple found from experiment, the mean value of which is 80 for rectangular pillars. In a pillar of this kind the plates would be joined at the corners by angle irons, then the breadth is measured between the edges of the angle pieces. Hodgkinson's experiments have clearly demonstrated that the wrinkling strain is independent of the length of plate. Experience has also shown that in long plate pillars the plate often fails near the end. As Mr. Box observes, the crushing strain due to flexure is a maximum at the centre, and at the ends it is *nil*; but the crushing strain of direct pressure is the same from end to end.

The best plan of strengthening plate iron against wrinkling is by the addition of angle irons or ribs, which practically reduce the breadth of plate. A centre rib, for instance, reduces the width to half, and the wrinkling strain is decreased 41 per cent. Indeed, the object in all structures composed of thin plate iron, like pillars and beams, is to reduce the practical breadth of the unsupported plate by cellular arrangements, by ribs or otherwise, such that the wrinkling strain shall be made equal to the crushing strain, or 19 tons per square inch. Those who wish to study the subject of wrinkling strain will find it handled in a masterly and exhaustive manner in Mr. Box's treatise. Thin plate iron pillars are seldom used by the architect; but the engineer resorts to them in the piers of bridges and other purposes, and he will find the addition of angle iron stiffeners increase the strength in a direct ratio.—*Building News.*

STEEL IN ITS RELATION TO MODERN GUNS.

AT a recent meeting of a number of artillery and naval officers at Karlsborg, Sweden, Captain John Bratt, of the Swedish Artillery, read a paper on "The Steel Industry and its Relation to the Manufacture of Modern Guns." The author has for many years been the Government inspector of Swedish gun factories, and has paid many visits to the gun factories of Russia, Germany, and France. In his paper, having given an account of the importance of iron in modern civilisation, the author stated that there was no other raw material which had been subjected to such a successful process of refining.

It was in its most important and interesting form, viz., steel, that he intended to deal with it on this occasion.

Captain Bratt proceeded to show, by drawings and diagrams, the metallurgical processes and methods of refining in use at the present moment. Having referred to the various kinds of steel and their manufacture, the author urged the necessity of subjecting all cast steel, of whatever kind, to a mechanical process of treatment by which the cavities which are caused by the gases contained in every steel bath are entirely removed. The steel, he said, should be perfectly close and homogeneous in order to be suitable for manufacture.

The means of obtaining this indispensable quality was the steam hammer. The largest at present in use were those at Le Creusot, Essen, and Perm (Russia). The latter rested on the largest block of cast iron in the world. It had a cubic contents of 83 cubic metres, and contained 700 tons of pig-iron. The difficulties, the cost, and, in some instances, the danger of forging great blocks of steel made it a matter of moment to discover some method whereby the gases in the bath might be removed and a homogeneous steel produced.

Such a method was discovered in 1870, and had been perfected at Terra-Noire, and consisted chiefly in adding a flux of silicon in the Martin furnace immediately before the steel is tapped. The author showed some samples of steel made at Bofors, in Sweden, by that method. One was taken from the hearth immediately before, and the other just after, the silicon was added. The former had a surface similar to a fracture, and was covered with blisters, whereas that of the latter was perfectly smooth. The Bofors iron works were the first Swedish works which had procured the Terra-Noire patent, and thus the first producers of this kind of steel in Sweden: and the method had a special interest to those assembled by the fact that guns of Bofors steel had been manufactured with the most satisfactory result, which led him to believe that Sweden would very soon make her own guns.

The author next gave an account of Krupp's manufacture of forged steel guns. The Essen works had in 1848 employed 72 men; in 1882 their number was 16,000, while some years ago they had in five months turned out no less than 1,400 pieces of artillery. In twenty-four hours the works could roll sufficient rails for a Swedish mile of railway (six English miles). Captain Bratt then referred to his personal study of the Krupp method. He had been present at the casting of guns at the foundry which had been established by Messrs. Krupp near St. Petersburg. He stated that the ingots for some of the largest guns numbered up to 500.

He then described the heating of the metal for forging, and the difficulties attending this operation, the forging under the steam hammer, whereby the cast metal is compressed to under four times its original size, and, finally, how the gun, after being bored and turned, is made red hot and hardened in oil. The author next gave an account of the experiments which had during the last few years been made in Sweden, to solve the question of producing first-class guns of close cast steel by the Terre-Noire method.

The trials made included the bursting of a smooth-bore 4lb. muzzle loading gun. It had shown a very high degree of resistance, and had, in fact, only been burst by loading it right up to the muzzle. No less than 1,041 shots had been fired from a 12-centimetre rifle breech-loader, which was at last burst under the excessive pressure in the chamber of 5,500 atmospheres, while the normal one was from 2,000 to 2,100. The last experiment was the firing of three 8-centimetre guns of the new model gun of the Swedish artillery. Each of these guns had, without suffering in the least degree, fired 2,000 shots with normal charges.

Two of them were then, after 152 and 154 attempts had been made, burst, under a pressure in the chamber of 5,000 atmospheres, the normal one being 1,800. The third gun could not be burst, but only cracked in the breech. All these guns had been cast at Bofors, and were finished at the gun factory at Finspong. In conclusion, Captain Bratt stated that lately a competition had sprung up between these two works, which had before worked in concord. This was caused by the fact that the problem whether first-rate steel guns could be made in Sweden had been solved, and that these two works desired in future to be dependent upon each other in gun making. At Bofors there was now erecting the plant required for finishing guns, and at Finspong a steel foundry. Both had received orders from the Government, and he trusted that at no distant date they would receive them also from foreign Governments.

MUSK.

MUSK is a secretion of the musk deer (*Moschus moschiferus*), which inhabits the alpine regions of the northern provinces of Thibet, and is also found in the southern borders of China and in Siberia as far as Lake Baikal. According to recent reports, it has been found in the provinces of Fohkien and Kiangsi, but does not seem to be hunted there.

The pouch that grows on the belly is about 2½ inches long, 1⅜ in diameter, and weighs about 30 grms. (over an ounce). It must be cut off as soon as the animal is dead, tied up, and dried. On the interior walls of this pouch is the musk, which looks like snuff, and which, if unadulterated, consists of smooth dry particles having a greasy feeling, is very friable, of a reddish brown colour, and has the peculiar and unmistakable odour.

There are two principal varieties, Tonquin and Yunnan musk. The former comes from Thibet and Szechuen, the latter from the province of Yunnan, and both kinds find their way to Shanghai through Chunking and Lankow.

In addition to the ordinary Tonquin and Yunnan there is a finer grade of each distinguished by adding the term Taupi, thus Tonquin-taupi and Yunnan-taupi, which signifies the musk without the skin, otherwise the pouch is included. Both grades have an extremely fine perfume and bring a much higher price, but find little use in Europe. The odour is perceptibly different from the common ware, hence it might be supposed that they were derived from a totally different animal or came from another region.

A third sort is the Cabardine or Russian musk from Tientsin. Its perfume is not nearly so fine as that from Tonquin and Yunnan, and the loss of hair, skin, and moisture is much greater, hence its value is much less. Tonquin musk is the one chiefly exported to Europe and America, Cabardine musk is less esteemed there, and Japan is the principal market for the Yunnan musk. In the first half of 1882 Japan took 340 catties of this musk.

For some time past there has been a marked decrease in the quantity of Tonquin musk received. The Chinese dealers attributed this to the establishment of a protective law in the hunting section. This circumstance combined with active demand in London and a small supply on hand caused the price to rise from 71 or 72 taels per catty in 1881 to 120 tael in 1882. (The Shanghai tael is 1 dol. 13 cents, and the catty weighs 1⅛ lb. avoir.) This hunting law is said to have been removed recently, but no change in price nor increase in receipts has yet been detected.

If some limit was actually put on the musk hunting in Szechuen and Thibet, at all events Yunnan did not follow the example, for the receipts from this province are always abundant, so that the total export of musk seems but littles less than last year. Independently from the fact that the price of Yunnan musk has followed that of Tonquin musk, the large production of the former has had little influence upon the business in Europe, where neither sort has increased in favour nor in consumption.

The Chinese firms that deal in musk have, as a rule, branch houses in the chief cities of Yunnan and Szechuen, and in Chungking, Zchang, and Lankow. They advance the money to the hunters upon the musk and thus prevent the article from falling into other hands than those of regular dealers. Every large musk firm has agents in Shanghai and Canton to look after the sales. In Shanghai there are only five "hongs" for Yunnan and Tonquin musk; they all live in the same neighbourhood, and there is no competition between them, as they form a kind of monopoly.

The business in other articles of export is done by brokers, or middle-men, who are foreigners and who carry samples of newly received products around to their customers, but with musk this is not the case.

Here the buyers must seek some other means of informing themselves when a new "chop" comes in, and the musk dealers seek to secure themselves from being too quickly deprived of their wares. Musk is sold here only in the original chests of 10 to 30 catties (averaging 20 catties), or in whole "chops." The buyer does not have his choice of the individual bags, cannot divide a chop, but must either take the original consignment just as it comes from the interior, or refuse it all. There is no particular season for musk; it comes in the market at irregular intervals throughout the entire year. The Carbadine musk brought from Tientsin is sold by special "hongs."

The export of this drug will always remain within moderate limits, not only because the production is limited by nature, but also because the Occidental demand has as a competitor the still stronger demand for home consumption. It is well known that in China everything smells of musk. Both sexes are accustomed to carry it with them in little boxes and to keep it in their clothes presses. While it is losing ground in European therapeutics, the cures attributed to it in China are very manifold, as may be supposed from their mythical nature.

When we consider that an export of 3,000 catties, each catty containing from 15 to 20 pouches of Yunnan, or 20 to 30 of Tonquin musk, means the sacrifice of no less than 60,000 musk deer, and this quantity has been reached several times of later years, and then if we add to this the consumption in China itself, which can scarcely be estimated, we see that it is not too much to fear the entire extirpation of this useful as well as graceful animal. Hence it would be desirable that the before mentioned rumour of the legal establishment of a period of protection should be confirmed, even if the development of this branch of trade should suffer some in the immediate future.

The adulterations of this ware seem to be as ancient as the trade itself. Du Halde mentions it as being very common and refers to pulverised rotten wood as one of the ingredients; and he also speaks of artificial pouches with which they avoided the law then in force against selling musk to foreigners. At present really pure musk scarcely comes into the market at all. Even the best chops do not contain more than 50 or 60 per cent of genuine substance, and on the average we must be satisfied with about 30 per cent.

The adulterants of musk are generally coagulated blood, a fatty earth (or ochre), paper, hair, pieces of leather, &c., which are introduced into the bags so skillfully as to require a sharp eye and years of experience to be able to detect it. It is not customary here to make any chemical test; the musk inspector takes out a little of the substance with a silver needle, notices its odour, and estimates its value. The pods or bags are immediately assorted according to the per centage of adulteration that he thinks he has discovered in it, and put in piles called 1, 2, and 3, for the European or American market, where this classification is frequently changed and others substituted.

Each pouch is then wrapped in Chinese paper and put in a pasteboard box lined with lead, and covered with silk. Each of these boxes contains a catty of musk; they are finally put in a wooden box lined with zinc. These boxes are of different sizes according to the size of the chop to be packed. They are generally shipped by the mail steamers, being placed in the safe reserved for bullion and treasure. These precautions are necessary on account of the high price of the goods as well as liability to evaporation. The ships of the old East India Company are not allowed to take any musk on board.

The total export for the last five years was 25,664 catties, or 33,875 lb., valued at 2,728,800 dols. The chief port of export is Tientsin; Shanghai and Canton export very little.—*From the Report of the German Consul-General in Shanghai.*

HYDROKINONE, A NEW DEVELOPER FOR GELATINE PLATES.

By Edwin Banks.

Hydroquinone, or hydrokinone, or quinol—for it is known by all these names—partakes very much of the nature of, and is closely allied to, pyrogallol. Like pyrogallol, it is a derivative of benzene. The solution of it is neutral to litmus-paper. It has a powerful attraction for oxygen, absorbing it when dissolved in water from the atmosphere, and more rapidly when rendered alkaline, though in neither case does it do so as rapidly as pyro; hence its solution will keep better, and, when mixed with alkali, retain its developing power a longer time than pyro. The chemical formula is also very similar. Pyrogallol has $C_6H_3(OH)_3$, and quinol $C_6H_4(OH)_2$; so that, it will be observed, while each contains six atoms of carbon and six atoms of hydrogen, which is the composition of benzine, pyrogallic contains three atoms of oxygen and quinol only two. Another resemblance to pyro consists in the fact that both exist in nature in certain vegetable productions: pyro exists as gallic acid in gall-nuts and oak-bark, and quinol as arbutive in the leaves of the arbutus, or berberry, and other *Ericaceæ*.

Commercially, quinol is made from aniline and from carbolic acid, both also benzine derivatives. It is first obtained as quinone ($C_6H_4O_2$) by the oxidation of aniline. One part of aniline is dissolved in eight parts of sulphuric acid diluted with twice its bulk of water. After cooling, a saturated solution of two-and-a-half parts of bichromate of potassium is added very gradually to avoid too great rise in temperature. At first a thick pulpy mass of aniline-black is formed, the reaction being the same as that which takes place in the aniline printing process. This shortly changes to a dirty brown solution. It is then treated with sulphurous acid in excess, when quinol or hydrokinone is formed. This is extracted from a solution by ether, and on evaporation crude quinol is left. Other methods are given, but sufficient has been said to give an idea of its nature. Its characteristics as a developer are of the most interest to photographers.

Captain Abney, who, I believe, was the first in this country to draw attention to its developing power, says that it is twice as powerful as pyro. It is very certain that it will bring out a fully developed picture with at least half the exposure necessary when pyro is employed. At first sight this appears strange when it is observed how much more powerfully pyro absorbs oxygen; but the explanation probably is in the fact that hydrokinone is more gradual in its action, and has a more "selective" power than pyro. With a collodio-bromide film, for instance, which is not so much protected from chemical action as a gelatine one, pyrogallic acts with such energy, when mixed with an alkali, that the whole film is reduced immediately, and no image, or only a faint one enveloped in fog, appears; hence there must be used a powerful restrainer to keep this action within bounds. A soluble bromide, which is usually used, has this effect, but, unfortunately, at the same time, partially undoes the work which the light has done, rendering it necessary to give longer exposure. But with hydrokinone no restrainer is necessary unless a great error in exposure has been made. It does its work rapidly and clean, in this resembling the ferrous oxalate; it does not discolour during development so much as pyro, and consequently does not stain the film so much, while full printing vigour is very easily obtained without having to resort to intensification. The colour and general appearance of the negative are more like the wet-plate process, since the shadows remain so clear and free from fog. It seems almost impossible to fog a plate with it.

A collodio-bromide, or even a collodio-chloride, plate exposed in the camera will develop clean and rapidly without any restrainer. This property of developing a chloride is very surprising, and will probably be very important. I have tried a collodion containing all chloride, with no trace of iodide or bromide or of free silver, and in the camera it is nearly, if not quite, as rapid as a bromide when developed with hydrokinone and an alkali; while I think it has the advantage in roundness and vigour. One grain to the ounce is strong enough for most purposes. With some samples of hard gelatine it is advisable to use two; but with most kinds and with collodion one grain is quite sufficient. I prefer using it with a saturated solution of washing soda as an alkali. Two or three drops of this to the ounce of solution of hydrokinone rapidly develops the image, and the addition of a few drops more to complete development is all that is needed. A soluble bromide acts very powerfully as a retarder and restrainer. With a mere trace added, development is very much slower.

Although its cost per ounce is greater than pyro-, an ounce of it will go as far as two of pyro-, so the difference is not so much as it appears. No doubt, if a demand sprang up for it, the price would also be reduced considerably. Many of you, I dare say, can remember the time when pyro- was seven shillings and sixpence per ounce, and hypo- two shillings per pound; but greater consumption, and consequent demand for them, soon brought these prices down. The same will doubtless take place when the value of hydrokinone becomes recognised.

I must not omit to mention, before concluding, another useful property of this developer—that is, its suitability for developing on paper either a bromide or a chloride film, whether it be produced by an emulsion, or by the older method of first brushing over the paper the haloid, and afterward the silver. The clearness with which it works renders it very suitable for this purpose, and for enlargement or printing enables pictures to be obtained with very short exposures.

CARBONIC ACID AND BISULPHIDE OF CARBON.

By John Tyndall, F.R.S.

Chemists are ever on the alert to notice analogies and resemblances in the atomic structure of different bodies. They long ago indicated points of resemblance between bisulphide of carbon and carbonic acid. In the case of the latter we have one atom of carbon united to two of oxygen, and in the case of the former one atom of carbon united to two of sulphur. Attempts have been made to push the analogy still further by the discovery of a compound of carbon and sulphur analogous to carbonic oxide, but hitherto, I believe, without success. I have now to note a resemblance of some interest to the physicist, and of a more settled character than any hitherto observed.

When by means of an electric current, a metal is volatilised and subjected to spectrum analysis, the "reversal" of the bright band of the incandescent vapour is commonly observed. This is known to be due to the absorption of the rays emitted by the vapour by the partially cooled envelope of its own substance which surrounds it. The effect is the same in kind as the absorption by cold carbonic acid of the heat emitted by a carbonic oxide flame. For most sources of radiation carbonic acid is one of the most transparent of gases; for the radiation from the hot carbonic acid produced in the carbonic oxide flame it is the most opaque of all.

Again, for all ordinary sources of radiant heat, bisulphide of carbon, both in the liquid and vaporous form, is one of the most diathermanous bodies ever known. I thought it worth while to try whether a body reputed to be analogous to carbonic acid, and so pervious to most kinds of heat, would show any change of deportment when presented to the radiation from hot carbonic acid. Does the analogy between the two substances extend to the vibrating periods of their atoms? If it does, then the bisulphide, like the carbonic acid, will abandon its usually transparent character, and play the part of an opaque body when presented to the radiation from the carbonic oxide frame. This proved to be the case. Of the radiation from hydrogen, a thin layer of bisulphide transmits 90 per cent, absorbing only 10. For the radiation from carbonic acid, the same layer of bisulphide transmits only 25 per cent, 75 per cent being absorbed. For this source of rays, indeed, the bisulphide transcends, as an absorbent, many substances which, for all other sources, far transcend *it*.

THE SALMON DISEASE.

An interesting lecture was recently delivered by Professor Huxley at the Fisheries Exhibition Congress, upon the disease which makes such ravages among fresh-water fish, particularly the salmon, and sometimes in the form of an epidemic. This disease, which is marked by the appearance of whitish patches on the skin of the fish, is attended with great mortality. In the last five years from 2000 to 4000 diseased fish have been taken out of the Tweed, and a like number from the Eden every year. Last year as many as 600 diseased salmon were taken out of a small river like the Leme. On the east coast a few cases have appeared in the Coquet, but none in the Wear. On the Tyne the disease is almost unknown among clean salmon, but it is common with kelts and dace. It may be said that there has been practically no epidemic outbreak in the eastern rivers south of the Tweed. The eccentric course of the epidemic, however, is shown in the fact that on the west coast the state of affairs is totally different, it having made its appearance more and more to the south, until last season it broke out in the Usk and Wye.

The disease is due to the fungus *Saprolegnia ferax*, which abounds in Irish waters, living on decaying organic matter, but having also the property of attacking living organic matter, so that the wonder is that salmon are not always diseased. Professor Huxley pointed out that it was desirable to ascertain the nature of the influences whereby the widespread sporadic disease suddenly assumes an epidemic character. On this point we have very little light at present, for although there is considerable reason for thinking that deficient oxygenation, whether produced by overcrowding or otherwise, may favour the production of the disease, and though it is probable that some kinds of pollutions may favour it, yet the disease sometimes becomes epidemic under conditions in which these two predisposing causes are excluded. The productiveness of a salmon river is not necessarily interfered with by even a severe epidemic, and therefore Professor Huxley's opinion was that on the whole it were better not to attempt to extirpate the diseased fish.

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Proceedings of the Institute.

The Institute being out of session no meetings have been held.

Monthly Notices.

The late Mr. Cromwell Fleetwood Varley, F.R.S., M.I.C.E., &c., who died on Sunday night last at his residence at Bexley-heath, Kent, has left a well-defined mark on the science of his generation and especially as that is represented in the development of the electric telegraph. His two Christian names indicate the line of his descent from the Protector, of whom his family count as among the nearest surviving descendants. He was born in Kentish-town April 6, 1828. His father was Mr. Cornelius Varley, who as an artist, was a chief pioneer of the school of water-colour painting in this country and the actual originator of the Old Water-Colour Society; and who, as a man of science, was the inventor of the graphic telescope and the author of improvements in the microscope. In his youth Mr. Cromwell Varley was robust and athletic, and his strength and courage in swimming enabled him to save two or three lives from drowning, for which he received a testimonial from the Royal Humane Society. Professionally, he devoted himself to the engineering branch of telegraphy, and devised a method of locating distant faults in land wires which attracted the special attention of engineers and electricians. Distinguishing himself by one discovery after another, Mr. Varley finally became chief engineer and electrician to the Electric and International Telegraph Company, and held this office until the taking over of the telegraphs by the Government. His inventions have been too numerous for bare capitulation at the present moment, and his patents date from August, 1854, to the current year.

Mr. Cornelius Whitehouse, the original patentee of wrought-iron gas tubes, the manufacture of which is now one of the staple trades of Wednesbury, died on Thursday, the 9th inst., in the eighty-ninth year of his age.

Prof. Ewing, of Tokio, Japan, has devised a new seismometer with much ingenuity. It is well known that an ordinary pendulum with its centre of gravity below the centre of suspension is in stable equilibrium. An inverted pendulum with a pivotted supporting rod is unstable. By placing such a pendulum below an ordinary one, and connecting the bobs, so that any horizontal displacement is common to both, the equilibrium of the jointed system is rendered neutral, and an exceedingly sensitive earthquake measurer is obtained.

M. K. Heumann, in the *Journal de Pharmacie et de Chimie*, calls attention to some curious phenomena attending the reproduction of sulphur vapours. It is known that sulphur heated on a plate of porcelain or metal to the point of emitting vapour exhibits in the dark a phosphorescent light of a pale blue colour, and gives an odour which affects the sense of smell as does hydrogen bisulphide, or camphor, or ozone.

Critical Points in Magnetism.—During the last meeting of the Physical Society Professor Hughes brought forward his magnetic experiments recently described by us, and one of the speakers remarked that soft iron brought to a red-hot state loses its property of being attracted by a magnet. As a matter of fact, Professor Hughes finds that this critical state is reached when iron is heated to a yellow-white, or just between white and red heat. Steel also loses its power of being magnetized when heated, and on being cooled to 100 deg. below zero, it again loses it. Nickel, again, loses its magnetic property at a comparatively low temperature, namely, that of boiling water, and Dr. Crookes has, we believe, devised a nickel cut-out, for electric lighting based on this curious fact.

Trouvé's Rheostat.—A very useful rheostat has been devised by M. Trouvé, the well-known Parisian inventor. It consists of a German silver spring enclosed in a nickel-plated tube, the spirals not being allowed to touch each other, and insulated from the tube by a paste-board sheathing. Inside the spring is a rubbing contact formed of a metal rod split into four parts, like the split plugs of a resistance box. This rod is graduated in divisions. The current enters at one end of the spring, traverses it, the rubbing contact, and the graduated rod. When the rod is deeply inserted into the spiral coil, the current only traverses a few turns, and the resistance in circuit is very small; but when the rod is pulled out the number of turns inserted is considerable. The divisions on the scale tell the number of turns in circuit. The device is employed by Trouvé in connexion with his polyscopes to regulate the strength of current supplied by a small Planté accumulator. The plan of splitting the rubbing contact is worthy of attention by electricians.

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TRAMWAYS.

SINCE the first introduction of tramways into England, in 1857, by Mr. George Francis Train, there have been over 450 tramway patents taken out in this country.

Some of these, however, have been of the flimsiest and most absurd description, and very few of any real or permanent value. It may be recollected with what laughter and ridicule the first proposition for street tramways in this country was met, and yet we find in the short space of about twenty years few important towns in the whole kingdom that have not their systems of tramways.

Somewhere about twenty years ago, Mr. Beresford Hope was reported to have said :—"I have often been button-holed in society about it, and I should say that the general population of London look upon the extension of tramways with dislike and apprehension."

At the present time there are nearly a hundred miles of tramways in the metropolis. In the whole of the United Kingdom there were, up to a very recent period, nevertheless, not 250 miles laid down, a length absurdly small when considered in connection with the magnitude of our towns and cities, and the recognised estimation in which tramways are now held.

In America there are many cities of even second-rate importance that have each their hundred miles of tramways. Buenos Ayres, with a population of only 100,000 people, has 105 miles laid. For the slow extension in this country of a tramway system there is, we think, some reason for which we have not far to seek. In go-a-head America they will rush extensively into almost any new thing merely for the sake of novelty. In hard-hearted England we hesitate, and wait for the results of the experience of others ; and it may be to consider we have not yet seen the best possible system of tramway construction.

There has been evidence that this latter consideration is the chief barrier to the more rapid extension of tramways in this country. Our corporations and public bodies appoint committees to travel from town to town, and exhaust every endeavour in order to ascertain what, in their opinion, is the most perfect system of tramway construction. The report generally ends unfavourably to every kind examined, and the result is the adoption of some independent method of their own ; for it is a matter of common observation there are scarcely two towns in the kingdom that have adopted an identical system in every respect. It is evident from this that there are considered to be imperfections in each system, and many faults common to all ; for if otherwise, we should certainly find one much more extensively used than the rest, just as the double headed rail, iron chair, and wooden sleeper system of laying railways has banished every other from the field. If a system obviating all the gross and common faults of the present systems can be found it will go far to supplant those now in use, and do more for the greater extension of tramways than anything has been able to do up to the present.

It has often been said that nothing in this world can be perfect. The permanent way of a railway—the embodied experience of fifty years and a hundred engineers—has many shortcomings : the fish-plates get loose and require screwing up, chairs require fastening down, and the sleepers require packing up. We shall not be surprised therefore, to hear unfavourable criticisms of any system,—inevitable to all human efforts,—but we firmly believe methods can be devised to meet all the objections that have hitherto been used by the exponents of tramways, and so successfully retarded their further extension.

We simply state a fact patent to every observer, that few, if any, systems have yet been able to effectually prevent the sinking of the sets adjoining the rails. Many have been expected to obviate this great fault, either by the sets resting on a base plate in connection with the sleeper or the rail, or by resting on a concrete bed ; but the fact remains that the sets *do* sink in connection with nearly all these methods. The reason for this is obvious. The set next the rail, whether resting on a substructure of iron plate or concrete, must have the usual layer of gravel or sand foundation to rest upon. Speaking of one individual set, it is supported on three sides only by the usual asphalte grouting, for on the side next the rail there is no support whatever,—the joint at this side probably breaking with the first vertical passing over it,—water finds its way to the foundation, the set gradually becomes loose, grinds into its gravel bed, and eventually rests on the base plate or the concrete, sinking below the top of the rail by the depth of the sand or gravel bed. To this great fault is principally owing the objection of carriage owners to tramways. It causes the girding of carriage wheels against the sides of the rails, strains the axles, springs, and wheels of vehicles ; and so violent is this action that it has been known to sprain the limbs of valuable horses, and pitch their owners headlong into the street.

Another great fault in most existing systems is, the sinking of the rail below the sets. For this possibly we can account by the following reasons :— We find at present a long straight joint between the rail and the adjoining sets. This joint is grouted with asphalte in the usual manner ; but there being no affinity between the granite set and the iron rail, this joint breaks along its entire depth. Water finds its way gradually into this joint and eventually reaches the foundation. The vibratory action of the rail and sleeper works with such effect with this water in the foundation as to gradually loosen the latter, and, in the end, causes that pumping action observable under passing tramcars, which lessens the rigidity so necessary to stability, and finally ruins the tramway.

It is no uncommon thing to notice on wet days long lines of water marking the positions of street tramways, leaving lengths of slimy deposit. It is quite usual to see, for a distance of several yards, the rail about half an inch above the sets, or the sets for a similar length, about half an inch and sometimes an inch above the rails. We often see the rail laid, as it were, in a shallow gutter, between the sets on either side Now, these are faults that are more than constructive faults—they are those that are observable by the public at large, and affect them in the highest degree. There are, however, purely constructive faults which affect tramway companies more directly, and which do not so much interfere with and concern the public. Amongst such we should class the want of the requisite degree of rigidity in the present systems—the absence of vertical and lateral stiffness in the support of the rail, and more particularly at the points of junction in the rail, all of which cause great wear and tear to the tramway, to the tramcars, and to the horses used in the traffic. Mr. Kinnear Clark, in his able work on "Tramways," says that "resistance to deflection must be the ruling consideration in the design of a tramway ; that deflection should be reduced to a minimum, since vertical stiffness is the first condition for ensuring a minimum tractional resistance." He further adds—that "vertical stiffness is an essential condition for ensuring the stability of the fastenings." How many tramways, we may ask, are constructed in accordance with these principles ? In any system of permanent way adopted for railways, elasticity is an essential and necessary consideration on account of the great speed of the trains passing over it. The slow speed at which tramcars run renders this condition in a tramway perfectly unnecessary. A large degree of rigidity is an important consideration in laying a tramway, which has to stand the wear and tear of a heavy street traffic in addition to that of its own horse propelled cars.

These considerations become forced upon our attention in view of the probable adoption, at a not very remote period, of some system of electrical propulsion for our tramcars ; which will certainly require a permanent way of a reasonably good and sound character.

It therefore behoves all towns contemplating the laying of a tramway system to carefully consider the difficulties, as herein stated, attendant upon most of the methods already before the public, and to see that such a plan is selected as shall ensure not only durability and the least possible hindrance to traffic ; but that shall be capable of adaption to the requirements of an extremely probable electrical progress, connected therewith, in the immediate future.

W. G.

THE VIENNA ELECTRICAL EXHIBITION.

As is invariably the case in the early days of the international exhibitions, the Electrical Exhibition of Vienna is still far from complete, although the managing committee have exerted themselves to the utmost, and have been hurrying up exhibitors most energetically. The opening really dates from Thursday (Aug. 23), for until the evening of that day it was an electrical exhibition without electricity, and in almost absolute darkness. The boilers were not supplied, and it is doubted whether, when those being put in are complete, there will be enough steam for the machines. The rehearsal lighting on Aug. 22nd was anything but a success, but on the opening night things went better. The Schückert dynamo maintains its stand at Vienna. In the upper gallery of the Rotunda there are 40 arc lamps by Schwerd and Schückert and others. The Schückert lamps are the same as the Pilsen, and the Schückert machines being very excellent, and the lights produced are excellent. The Schwerd lamps are also good; they are constructed with the greatest mechanical ingenuity, the regulating apparatus for keeping the carbon points steadily at the same distance apart being very ingenious. In spite of this complication it is found less liable to get out of order than some other arrangements that are not so efficient in steadying the light. In all these lamps the principle of the regulating mechanism is the same. The electric current is divided into two streams through the lamp. The path of one of these offers a comparatively high resistance to its passage, and, therefore, only a small fraction of the current passes through it. The main current passes through the carbon pencils (which are usually round sticks about three-eighths of an inch in diameter), leaping over the space left between the points of these two pencils above alluded to. This space is in ordinary working rather less than 1-8th of an inch. This gap in the circuit offers considerable resistance to the passage of the electric stream, so that it requires a certain difference of tension or "potential" to enable it to make the leap. If the gap becomes wider, the resistance is increased, and, therefore, less of the current flows through this main circuit, and more is forced through the shunt. Now the wires of either one or both of the main and the shunt circuits are coiled round either one or two of the bobbins, which thus form electro-magnets. Through the hollow of the bobbin passes a moveable iron core, which is drawn inwards by the magnetism more or less, according to the strength of the current. In some lamps one of these iron cores is attached directly to one of these carbon pencils. When the current through the shunt is increased in consequence of the burning away of the carbons and of the resulting greater distance and resistance between their points, the movement of this iron core is such as to make the carbon points approach once more. In others the movement of the soft iron core actuates an escape lever so as to set in motion for a second or so a clockwork which accomplishes the same end—namely, the approach of the points. Since the unsteadiness of the light is caused by the variation of the length of the gap between the points, the above explained mechanism rectifies this unsteadiness. It must be observed, however, that this system of regulation—the only one as yet invented for arc lamps—is by no means a perfect one. The differences between different systems are due to a greater or less sensitiveness, that is, in one the change is made, the regulator comes into operation as soon as a very small percentage variation of light has occurred, whilst in others the movement occurs more tardily and a greater proportionate approach towards extinction is permitted before the regulator begins to move and correct the fault. In most modern lamps another shunt provides against accidents due to the increase of the current sent from the machine to a dangerous extent, whereby the lamp might be injured. In Schwerd's lamp an ingenious and very simple arrangement ensures the current its way through the lamp until the glass globe has been put on, and again the current is automatically shut off when the cleaning door in the side of the globe is opened, and turned on again when the door is shut. The Brush lights show up admirably, and the absence in them of that ghastly whiteness observable in some of the systems is rather an advantage than otherwise. The lamps in the first tier—70 or 80 arc lamps are furnished chiefly by the Anglo-Austrian or International Electric Company; but some are by Siemens and Halske, and most of the remainder by Piette and Krizik, a Hungarian company, which works the patent for the Pilsen lamp. The lamp is one of the simplest of the arc lamps.

Incandescent lamps form a prominent feature in the display, the great feature of novelty being the Bernstein lamp—an American invention—in which an extremely thin tubular carbon is used, giving a very large amount of surface in proportion to the material used and electrical resistance. The Bernstein lamp is agreeable to the eye, owing, it is said, to the large surface given to the carbon. The lamp is at present made in two sizes, one giving from 150 to 200 candle-power, the other from 200 to 300. The one requires only 25 volts and the other 50, according to the statement of the inventor. One peculiarity of the lamp is, that a return has been made in it to the system that has been frequently tried, and hitherto found impossible to carry out successfully—of having, instead of vacuum, a certain vapour inside the glass, which is said to prolong the endurance of the carbon, instead of destroying it. It remains to be seen whether this lamp will exhibit the endurance claimed for it by its author. The Commission will make careful tests of this and the other new lamps, and, until the results of these tests have become known, it is impossible to decide upon their respective merits. These big lamps will disabuse the public of a mistake they easily fall into—that incandescent electric lamps do not radiate any heat along with their light. One can easily with the hand feel the heat thus radiated. This, however, does not prevent them having an enormous influence in keeping down the temperature of a room or hall and in keeping the air pure. As we have no combustion we have no heating and vibration by the atmosphere by the products of combustion. The Paris Edison Company exhibits a lamp of 100-candle-power, the ordinary size used in London being 16-candle power. The difference is one merely of dimensions of the strip of charred carbon through which the current passes, and which it heats to a high degree of brilliancy. The difficulties in the manufacture of the carbon strips are very great; but they have now been so far overcome that it is possible to produce these large and powerful lamps. A new large incandescent lamp is also exhibited by the representatives of the Swan Company. The carbon strip takes the same external form as the Edison, and is bent in one arc only. It is thicker and larger than the Edison. The essential and patented difference consists in the mode of manufacture. They are made in various sizes up to 200 candles. A French company, which carries out M. Gerard's inventions, has a lamp in which inside a large pear-shaped glass stand four straight filaments of carbonised straw joined at their extremities in two pairs, so as to make two circuits for the passage of the current. The intensity of the illumination has not yet been actually measured; but the ordinary power of the lamp lies between 200 and 300 candles. To illuminate this, of course, a current of high electro-motive force is required, 60 volts being needed between the terminals of the lamp. Some attention has also been attracted by the Miller lamp, an improvement on the Swan, the carbon being much elongated; it gives about 50-candle power, and is a very agreeable light.

There are plenty of dynamos and secondary batteries, but there is nothing particularly new. The principal machine of this class is an alternating current dynamo, by Gauz and Co.; it is the largest machine in the Exhibition; it is combined with a vertical steam-engine for driving it, the two having one common shaft. It does a large amount of useful work throughout the Exhibition in feeding arc lamps. The incandescent lamps require a continuous current, and this is one of the reasons why the great majority of machines are now designed for this kind of current. Among the dynamos of special interest must be mentioned those of Siemens used on his electric railway and a pair to be used in a small launch which will run on the Danube Canal. The boat is 40ft. long and 6ft. beam, and accommodates about 40 people. Since conductors to lead the current from a stationary dynamo to the moving ship are impossible, the driving dynamo of this ship is fed by a battery of 80 accumulator cells, which are part of Messrs. Sellon and Volckmar's exhibit. Each of these 80 cells, if it were advisable to fully exhaust them, which it is not, would be capable of exerting one-horse power for the space of one hour. They are to be charged once a day by a dynamo fixed at a central station on the shore. The boat has been driven by this means at a speed of 11 knots per hour, but the speed intended to be usually kept up is eight knots. The Sellon-Volckmar Company also shows a tricycle to be driven by two or four cells similar to the above, but specially constructed with a view to compactness.

It is well known that the Faure-Sellon-Volckmar secondary battery, or accumulator, is made of perforated lead plates plastered over with minium, and dipped into boxes filled with dilute sulphuric acid. A German, Herr Kornblüh, makes almost identical cells, except that his layer of minium is of double the thickness that Volckmar uses. The original Planté cell, composed of plates of lead simply and the dilute acid, are also exhibited, as well as various modifications of it by Mr. Barrier, by the International Electric Company, and by the United States Electric Company, the patentee of whose cell is Mr. Kabath, of Paris. The design of this last shows very great mechanical ingenuity and skill. The object is to get as large a surface with as small a weight of lead as possible. The action of all these boxes is the peroxidation of lead, and it is well known that it is difficult, if not impossible, to make this oxidising action penetrate deep below the surface. The interior of the thick plates ordinarily used is wholly wasted, unless a very long time is spent in the "charging." Mr. Kabrath has, therefore, built his up of extremely thin strips, about ⅜ in. wide. There are about 190 of these laid one on the other in a pile 3¾ in. deep, and bound together by an envelope of thicker sheet lead. In order to allow access of the acid to all these surfaces every alternate strip is corrugated, the corrugated or rippled surface being produced in rolling the sheets. This extremely ingenious design deserves success, and, according to the inventor, has already obtained it.

The telephones and microphones exhibited are very numerous, and some surprising feats have been performed with them. The most conclusive was that where a gentleman's singing and a lady's zither accompaniment thereto were distinctly audible though the singer and his accompanyist were ten miles distant from each other, the one being 40 miles and the other 50 from the room in the Exhibition, in which they were being attentively listened to. Another feature is the electric-lighted cab; driven by Leopold Frank, who has the honour of being the first to introduce this kind of illumination into vehicles of this class. There is a model theatre lighted by electricity, but the object of exhibiting it is evidently to show its improved general construction.

EXTINCTION OF FIRE—THE ZAPFLE APPARATUS.

A SERIES of interesting experiments in connection with the prevention and extinction of fire took place at the vacant Crown Lands, Whitehall Place, on Thursday, August 23, in the presence of a number of Admiralty and other officers and scientific gentlemen, the object being to ascertain the merits of the Zapfle patent fire-extinguishing liquid and hand-pump, the superiority of which has already been extensively recognised, both in France and the United States. The liquid appears to possess the power not only of extinguishing flame with great rapidity, but at the same time to render the structure or material with which it is brought in contact virtually incombustible. Thursday's experiments were arranged to demonstrate both these facts. In the first place, a wooden house saturated with the Zapfle liquid was severely tested to show that it was practically impossible to ignite it, and a similar structure not previously prepared with the liquid was set fire to in order to show the rapidity with which even a dangerous fire can be subdued and extinguished by the aid of the extinguishing fluid. From the behaviour of fire upon muslin curtains, actresses' dresses, and theatre scenery treated with the liquid, it is not improbable that salts of alumina form one of the ingredients which Mr. Zapfle employs; but as he claims that the composition of the liquid is a secret, it would be difficult to give precise details concerning it without carefully analysing it. Its exact composition, however, is a matter of secondary consideration, since its action both in rendering materials incombustible and in extinguishing fire is all that need be desired.

The pump itself is a 5 gallon or 6 gallon pump, such as is ordinarily used by firemen for extinguishing small fires, but is double-acting, so as to throw a continuous stream. Its real efficiency, however, appears to depend principally upon the use in it of about one part of the Zapfle liquid to four parts of water, and when applied as soon as fire makes its appearance the effect is instantaneous. In France the apparatus and liquid have been thoroughly tested during the past four or five years, and the reports to the War Department, the Ministry of the Interior, and the Prefecture of Police by the officers entrusted with the experiments are most encouraging. It is well known that the use of solutions of salts are chiefly valuable when fire has just broken out; but if such an apparatus as the Zapfle hand-pump be within reach—that is to say, in the same building — it is quite improbable that any serious damage would result from any of those little fire accidents which but a short period of neglect render so disastrous; indeed, the Commission of Sapeurs-Pompiers (Government firemen) of Paris, appointed to test the system, reported that "whatever may be the value of the salts which compose the Zapfle extinguishing liquid, this product, thanks to the apparatus used for throwing it, may play, better than all its rivals, a very important *role* in a house at the instant a fire breaks out. The pump is really very portable, and the water as well as the solution can be replenished. The working presents no danger to the person using it, and the jet obtained by the rapid movement of the piston is sufficient. Whenever the regiment of Sapeur-Pompiers has been consulted, either by private persons or by large administrations, as to the employment in limited spaces of these apparatus, it has always expressed a favourable opinion, and now that the corps knows the Zapfle apparatus it will be most certainly that to which preference will be given."

And that this favourable view has not been without effect upon the Government is evidenced by the fact that three years' contracts —most of them for 500 apparatus—are now being executed for the French War and Naval Departments, Artillery, Engineering, and Military Stores and Arsenals, Public Works Department, State Railways, and so on. The apparatus, according to the specification in the Government contract, is composed of a cylindrical zinc reservoir well soldered, provided at the lower part with a cavity forming a foot plate, and closed at the upper part with a cover half fixed, and the other part opening on a hinge. A zinc handle strongly soldered, or otherwise fastened to the fixed portion of the cover, serves for carrying it by hand. It is furnished with a brass pump, which is joined to the base and to the cover. The pump is on the American system, combining suction and forcing. The piston, formed of two brass washers, between which hemp packing is rolled, is fixed upon a straight brass rod, the top of which has a wooden handle. The air-chamber is formed round the pump by a concentric cylinder, and the communication between the pump and the air-chamber is through an agate ball valve, and there are, of course, outlet tube and suitable arrangements for attaching the hose. In its use and action the pump is so closely similar to those generally employed that it may safely be put into the hands of anyone, and does not appear liable to get out of order. The experiments altogether passed off most satisfactorily.

SEPARATION OF NICKEL FROM COBALT.

By G. VORTMANN.

THE author, after pointing out the defect of all the ordinary methods of separating these metals, suggests the following process, depending on the oxidation of cobalt salts in ammoniacal solution by sodium hypochlorite. When such a cobalt solution mixed with sal-ammoniac is treated with this reagent, complete oxidation takes place, even at ordinary temperature, the liquid assuming a red colour. The reaction is accelerated by boiling, the solution in a few minutes assuming a deep reddish yellow colour, and then containing the cobalt chiefly in the form of a luteo-cobaltic salt. On diluting with water after cooling, and adding a small quantity of potash solution, the liquid, if it contain nothing but cobalt, will remain clear even after standing for several hours, but nickel if also present will be deposited in a short time as hydroxide. In this manner, mere traces of nickel may be detected in a cobalt solution, and likewise a very small quantity of cobalt in presence of nickel. A blue ammoniacal solution of nickel containing a very small quantity of cobalt usually exhibits, after treatment in the cold with sodium hypochlorite, a distinct red-violet colour; but even if the quantity of cobalt present is too small to produce this effect, the liquid, after dilution with water, addition of potash lye, and filtration from precipitated nickel hydroxide, will exhibit a faint yellow colour; and if the quantity of cobalt be too small to produce even this faint colouration, its presence may be detected by the black precipitate formed on addition of ammonium sulphide. If the quantity of cobalt present is sufficient to give the solution a strong red colour, the cobalt-ammonium compound contained in it will be decomposed on boiling, with separation of brown cobaltic hydroxide. As nickel hydroxide is dissolved in small quantity by ammonia, even in presence of potash or soda, care must be taken in the first stage of the process not to add too large an excess of ammonia, as it would then become necessary, in precipitating with potash, to dilute the liquid to a considerable extent, which would interfere with the subsequent operations.

The author gives the details of a number of experiments made by this method, showing that in many cases it gives results more exact than those which are obtained by the use of potassium nitrite or potassium cyanide.—*Monatsh. Chem.*

ON SANITARY REFORM.

THE Rev. S. Barber, in an article in the *Journal of Science* for August, remarks as follows:—

We may regard the question of public sanitation as affected by the efforts of the people for their own benefit, or by the influence of local authority, and the perfecting of the machinery of the central government. There can be no doubt as to the utility of instructing the people in the laws of health, while the ascertaining of the best method of government depends partly upon experiment. But if we were disposed to apply an exhaustive and rigorous analysis to determine the *fons et origo malorum* of unhealthy conditions, we might, perhaps, arrive at the simple conclusion that these may be summed up in the single word "selfishness." But this would be proving too much, like the ingenious etymologist who reduced all the radicals of a language to a single letter. The forms of selfishness, indeed, are marvellously varied, both in character and degree. The collier or brick-setter who neglects his own household, and outrages the *laws of health* in his humble dwelling, is certainly blameworthy, but the apathy and selfishness of a chairman of trustees, or a medical officer of health, is a matter of much more serious import to society, and more culpable in itself.

Let us take for granted that all the intelligent inhabitants of any ordinary town, not excepting the *(so-called)* "*working* classes," or at least a majority of these, are in favour of *real* sanitary improvements. The desire of self-preservation, taken in the aggregate, necessitates the existence of this feeling in society. It is now quite needless for the members of health committees to pour forth impassioned orations upon the general question of sanitation, It is the management, the details of a scheme, the workmanship, and the financing which chiefly concern the ratepayer.

It is now some time since the English people became impressed with the feeling that it is better economy to expend public money upon elementary education than upon the maintenance of criminals undergoing imprisonment. Thus the public education has long since passed the experimetal stage, and it is no longer an open question as to the public duty of providing a modicum of mental training *for the whole population.* He would be a bold man who should stake his popularity by pandering to the prejudice of a still existing minority, in advocating a policy of retrogression. But though the machinery of elementary education is now regarded as an established and inevitable fact, there remains still a vast field open for educators, theoretical and practical, in the discussion of details and the application of statistical analysis.

But in the case of sanitary improvements, or rather in the reduction of our social arrangements to the demands of sanitary law, this stage of public feeling has not yet been reached. The desire for improvement exists, but the public are not yet instructed in the principles of public health. Too many among us—not only average ratepayers, but guardians, teachers, magistrates, and medical officers—regard the appliances and regulations of sanitary science as having their sole *raison d'etre* in abnormal and extraordinary social conditions. By such persons these things are not looked upon as essential to healthy life. Thus we find that sudden and ill-advised attempts at sewerage, insufficient water-schemes, and the like, often take their origin from some panic which has seized upon the public mind, or from the effects of an epidemic. Work thus initiated cannot, of course, be so complete or so successfully applied to effect the desired end as that which is deliberately undertaken in the "quietness of thought," and as matter of *principle* always binding upon society. What should we think of the captain who had his vessel put in trim for fair weather, and then set off to sea on the assumption that fair weather would continue throughout the voyage? Yet this has been too much the method of procedure adopted by those who have had the care of public health placed in their hands. And any man who proposes the arrangement and construction of a town upon true sanitary law will for a long time be regarded as a dreamer and an enthusiast.

THE STARS AS SEEN IN EGYPT.

At a recent meeting of the Royal Astronomical Society Prof. C. Pritchard gave an account of his recent expedition to Cairo, and of the work on which he has for the last two years been engaged, viz., the measurement of the magnitude of the stars visible to the naked eye from the pole to the equator, including at present all those brighter than the fifth magnitude. This work is now complete. He found that, at Oxford, Laplace's law of alteration of a star's light as measured in magnitude—according to the secant of the star's zenith distance—did not hold good for zenith distances exceeding 65°, and that for stars at lower altitudes the alterations in apparent magnitude were conflicting and not satisfactory. For the purpose of accurately investigating the effect of atmospheric extinction of light under better circumstances he chose the climate of Upper Egypt, where the atmosphere is uniform and stable, as the proper locality for repeating the Oxford observations, and rendering the research complete. A duplicate set of instruments was at Oxford in charge of the senior assistant, who observed the same stars with Professor Pritchard at Cairo. The results of both sets of observations are embodied in the formulæ:—

Atmospheric absorption—
At Cairo $= 0{\cdot}187 \times \text{Sec. Z.D.}$ in magnitude.
At Oxford $= 0{\cdot}253 \times \text{Sec. Z.D.}$ in magnitude.

Thus the whole effect of the atmosphere at Cairo is to diminish the brightness of stars seen in the zenith by about two-tenths of a magnitude, and at Oxford by about one-fourth of a magnitude. At an altitude of about 30° the stars at Cairo will be brighter than in England by about one-fifth of a magnitude, and consequently many more faint stars are just visible at Cairo than can be seen at Oxford.

Asphalte as Fuel.—Inventors ought to find a good field in the study of some effective means to utilise asphalte as fuel. The solution of this question would be of great service to this country. It is said that many of what were thought to be coal-mines, recently discovered in various parts of Mexico, are really deposits of bitumen. Now while asphalte is highly combustible there seems to be at present no practicable method to utilise it as fuel, owing to its melting when subjected to heat. It is likely, however, that with the demand for cheap fuel now felt all over the country for railway, mining, and other industrial purposes, some effective method can be devised to make practical use of its heat-producing qualities; burning it, perhaps, after reducing it either to a liquid or vapourised form. The inventor of such a process could command a handsome fortune for the use of the right in this country. The products of the new oil-wells in Vera Cruz, much of which are said to be too heavy for illuminating purposes, might also be utilised in the same manner.—*Mexican Financier.*

MATTHEWS'S IMPROVEMENTS IN PREPARING AND FINISHING CASTINGS.

The principal objects in the invention relate to improvements in finishing machinery bearings by cleansing and freeing the whole surfaces, and the pores or inundations of such bearings and bronze or brass castings subject to friction wear and tear, of that siliceous scale or skin taken up from the sand forming the moulds of such castings by the molten metal, and the same is at present bored and faced off in the lathe; and in some instances—as for tin-rolling and steel-rail rolling mills—the same bearings at present are partially and uniformly filed or scraped on their bearing surface only; and the fact of this work taking more off one place than another gives to the bearings an unequal surface, and in the absence of files and the labour necessary to use them, the bearings are put into their respective places, and used just as they leave the foundry trimmer, and the different journals, roll necks, &c., have to contend with the many evils (too well known to engineers and millwrights), and injuries in the shape of extraordinary friction in all parts, wear and tear, and scoring both the journals and their bearings to such an extent as to sometimes necessitate their being again faced or turned up. The grit, in fact, thus given out more or less is ground into the roll necks of journals, thereby causing the bronze bearings to rapidly wear out, together with the journals, the grit having much the effect of emery; and remaining as it does about the axle for a very considerable time, notwithstanding the extra greasing and extra attention demanded in all these cases. To overcome these difficulties at a cheap and expeditious rate, recourse is had mainly to the following plan of treating such castings:—They are subjected to the action of sulphuric acid (or any other suitable acid may be used), and of suitable strength, placing such casting separately, or several castings together, in a cistern containing the necessary acid, subjected to dry heat, or that of steam may be used, or the acid applied in any other form, or applied to the wearing or motion surface only, or the whole surfaces, for the purposes described. In performing upon several castings at one operation, they should be placed upon a suitable platform, which may be suspended or otherwise, and made to lower with its load into the said bath or cistern, and the whole immersed, then to be moved in any direction for the purpose of agitating the acid. When sufficiently oxidised the work so operated upon is withdrawn, and the whole passed to the No. 2 bath, containing a continual supply of cold water. It is thoroughly swilled therein, afterwards dried, and then rubbed all over by hand or by any suitable machine, using any suitable substance or powder for rubbing or polishing purposes (say card-wire), and after a few strokes or rubs a clean bright surface of the pure metal or bronze is obtained. The inventor says;—"I would here remark that I am aware of acids and spirits being used in cleansing brass castings for lacquering and bronzing the same. But my invention relates to the application to the cleansing, polishing, and superior finish of machinery bearings and castings subjected to friction, wear and tear, and of any one surface, or the whole surfaces, or any part thereof."

The advantages claimed for these improvements are as follows:—1. Saving of metal in boring, which metal being retained in the casting is used in duty performed by the machine. 2. Fitters' time and tools used in boring and otherwise fitting. 3. Saving of friction and scoring the axles and brasses, as in all cases where bearings are used without being first bored the fact of this saving will effect great economy in wear and tear of every part forming a mill, engine, or machinery of every description, and especially railway rolling stock, steel and iron rail mills, and tin plate rolling mills, and hence economy of steam and therefore fuel. The siliceous matter taken up from the sand by the molten metal, as in the ordinary way of casting, is entirely struck off the whole surfaces and metal's pores by this new process of manufacture, leaving every particle of such casting's surfaces pure, so that the journals, axles, or roller-necks will have clean and true surfaces to receive them.

ANTHRACENE FROM PETROLEUM RESIDUE.

The conversion of the hydrocarbons of the marsh gas and ethylene series, observes M. Delahaye in the *Revue Industrielle,* into hydrocarbons of the aromatic series, was considered impracticable before the recent researches of Burg and Liebermann upon the distillation of peat tar, and those of Beilstein and Kurbatow upon Caucasian petroleum. These chemists have established that the hydrocarbons of these latter substances do not belong to the series of marsh gas and ethylene. Berthelot has shown that, in the distillation of coal, ethylene and its analogous constituents of tar are derived from acetylene. Letny has obtained benzol, phenol, naphthalin, anthracene, &c., by distilling petroleum residue. Liebermann and Burg have prepared these bodies by distilling peat tar. MM. Nobel Brothers are developing this industry at Baku; and the anthracene which they extract from naphtha refuse is obtained in a green mass containing from 25 to 35 per cent of pure anthracene. In order to prove that this crude anthracene is suitable for the production of alizarine, a sample of alizarine oil of good quality was made from it at Ludwigshafen, and was exhibited last year at Moscow. The naphthalin was quite pure; but the benzols, although boiling at between 80° and 85°, contained a great proportion of foreign carburets, and were not suitable for making nitrobenzin. However, it has since been found possible to purify these benzols by lowering the temperature to —14°, which is easily done in Russia. The naphtha residuum of Baku is utilised in making heating and lighting gas, and from this a tar is obtained which is afterward distilled in the same manner as coal tar. Every 1000 kilos. of naphtha residue will yield about 500 cubic metres of gas, 300 kilos. of tar containing 0·6 per cent of crude anthracene, and 17 per cent of crude benzols, boiling at 120°, and giving from 4 to 5 per cent of benzol and toluol. The house of Nobel Brothers last year had 200,000 tons of petroleum residue to dispose of, and of this only 900 tons were treated by distillation. From this was procured 1,500 kilos. of crude anthracene and 15 tons of 80 per cent benzol. This year the firm expect to make 42 tons of crude anthracene and 500 tons of benzol. Seeing that the European production of alizarine requires from 4000 to 5000 tons of crude anthracene yearly, M. Delahaye opines that it will be long before the competition from the Caucasus will become formidable. The great difficulty at Baku is, moreover, to find capital for establishing factories capable of working up the 250,000 tons of residuum actually disposable.

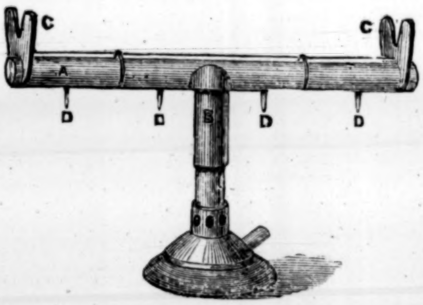
Mr. Geo. W. Wilson, of Lanesborough, Minn., is the patentee of a very simple separator and purifier for grain, meal, &c. This machine is provided with a number of sieves which are set in a frame, and shaken by the rocker that is mounted upon a rotary shaft, the grain being delivered on to these sieves through a spout. In the space above these sieves is arranged a suction blower for carrying away the dust and chaff from the grain. Suitable slides are arranged for regulating the power of the blast, and the sieves are so arranged that they may be changed according to whether grain, fine middlings, or meal is to be purified.

A LONG-FLAME BUNSEN BURNER.

By W. Ramsay, PhD.

I Have long felt the want of a Bunsen's burner which should heat short lengths of combustion-tubing to redness for such purposes as incinerating weighed amounts of ash containing carbon, separating small amounts of elements which form volatile chlorides from elements the chlorides of which do not volatilise at a red heat, and for similiar operations. Such a burner should be easy to manipulate, efficient, and inexpensive. I have devised the form represented in the annexed figure, which, I think, fulfils these requirements.

It consists of a brass tube, A, with a brass T-piece, which can be fitted on to an ordinary Bunsen's burner, at right angles to the tube A. The horizontal tube is slit from end to end; it is closed at both ends, and provided with supports, C C, in which the glass tube rests. As a substitute for stopcocks are four pieces of wider brass tubing which encase A, also slit along top, provided with brass pegs, D D D D, by means of which each can be moved so that the slit in A no longer coincides with the slits in the encasing tube. When the two slits coincide there is free passage for gas; but when the external tubes are made to revolve on A the gas is shut off, and the flame is extinguished. Each encasing tube is 2 inches long, the whole tube being 8½ inches in length. At one end of A a circular piece of brass projects for 3-16ths of an inch, and on the lower side a short peg is inserted. On the other end there is a corresponding annular projection, designed to receive the circular projection of another burner: in the ring there is a slot into which the peg from the second burner fits. The object of this is to connect one burner with another so as to form a furnace of a series of three or four burners. Such a series answers the purpose of an ordinary combustion-furnace, and has the following advantages:—It is much less cumbrous; the gas can be more conveniently regulated than in an ordinary furnace, and combustion-tubes consequently last for a longer time; there is no disagreeable smell, so that a combustion-room is not required; the combustion can therefore be performed on an ordinary laboratory bench; and the length of the furnace can be modified by using as many or as few burners as desired. There is, moreover, no danger of the flame "burning below"; it is a clear blue flame.



For organic analysis it is advisable to have special Bunsen's burners, giving flames about 10 inches high, else the temperature is not sufficiently high; but the combustion-tube must then be protected with wire-gauze. To prevent upward radiation of heat it is convenient to lay on the top of the tube several long pieces of asbestos cardboard: these are easily removed by crucible-tongs during the combustion; hence its progress is easily watched.

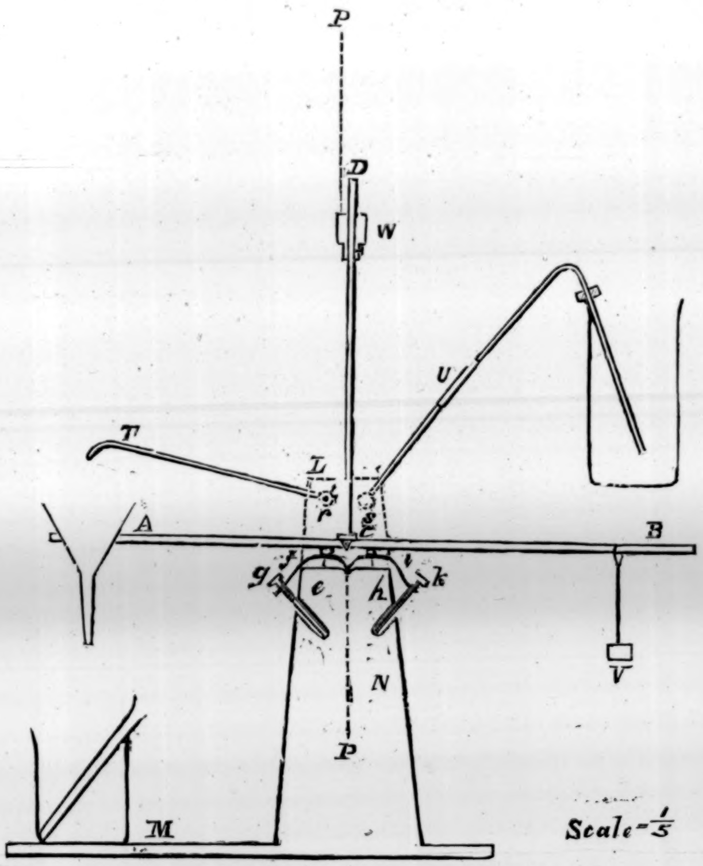
By performing the combustion in an open tube, in a stream of oxygen, it is easy to complete four in a day of six hours with a double set of absorbing tubes and bulbs; and indeed a rapid worker may accomplish seven. This, of course, depends on the nature of the substance burned; but with bodies which have a large carbonaceous residue when heated, such as sugar, no attention is needed after the first evolution of gas has ceased, and while the combustion is proceeding the second set of tubes may be weighed.

I have only to add that aflame may be regulated by turning the external tubes quite as well, if not better than, with stopcocks.=*Chemical News.*

FILTRATION BALANCE.

By F. P. Dunnington.

All the arrangements for the automatic washing of precipitates, of which I have seen previous mention, provide for keeping the water at nearly a constant level in the funnel. By this method of washing a precipitate, usually much more water is necessary than if each portion of water is allowed to drain off before a new addition of it. At the Cincinnati meeting of the American Association for the Advacement of Science in 1881, Prof H. Carmichael, of Bowdoin College, Maine, exhibited a filtration and evaporation balance, which I must describe before giving my modification of it. The figure, without the upright CD, illustrates this balance, which is most convenient for delivering a large amount of liquid on a small filter or into a small evaporating dish. A beam A B balanced on the knife-edge (or pivot) C, supports in a ring, A, the funnel which is equipoised by the weight V. *s* and *r* are corks passed through the upright NL, and hold in any position the tubes U and T, which are bent to pass through them. Close to C, and under the beam, passes a rubber tube *e*, which connects the tubes U and T and conducts the wash-water or other liquid. By use of thumbscrews *g* and *k* the little brass arms *f* and *i* may be raised to adjust the pressure upon the rubber tubes *e* and *h*.



To the above-described apparatus, I add a vertical rod CD fastened to the arm AB and at right angles to it; on this is supported a weight W, whose height is fixed by the binding screw also sliding on this rod. I employ for two-inch funnels a cylindrical lead weight V, weighing about 300 grms.; for three-inch funnels about 500 grms. The apparatus is used as follows; Having brought all the precipitate on the paper in a funnel, allow it to drain, put the funnel in place and fix the weight W near D, then slide the weight V on B until it will just be able to raise A from its lowest position, when of course W will move to the right of the vertical PP. Then water will pass through *e* and drop into the funnel until it is nearly full, when (if W and *k* are adjusted properly), A will fall, bringing W to the left of the vertical, and in this position no water will pass through *e*. When the funnel has again drained, the arm A rises, and (the water again flows into the funnel) this alternating motion continues so long as water is supplied. I have made AB of iron 10×4 m.m. The upright NL is 35 m.m. thick; other dimensions may be taken from the figure. It is essential that the tube *e* admits of being closed by very gentle pressure (less than 100 grms.) of the knife-edge cut on the under side of the beam. I use for this pure rubber tubing 2·5 m.m. exterior diameter.

Removing W the apparatus may be used as was intended by Prof. Carmichael. When conducting an evaporation, the dish rests in A and the gas passes through *h* to the burner, so that when the liquid is exhausted, and before that in the dish has come to dryness, the arm A will rise, compress *h*, and so extinguish the flame.

Estimating the Value of the Wines of the South.—A Audoynaud's method consists in mixing 5 c.c. of the wine with 10 c.c. of a solution of baryta saturated in the cold. A precipitate is formed, which if washed immediately in boiling water, gives a liquid unstable in the air, readily oxidised, and of a yellowish colour. After having removed the excess of baryta by a current of carbonic acid, and made up the liquid with water to 100 c.c., the proportion of yellow colouring matter may be judged of on oxidising with a standard solution of potassium permanganate. The numbers thus obtained, compared with the alcoholic standard of the wine, enable an opinion to be formed on its value.

BEER, WINE, AND LIQUOR.

In a recent publication—"The Brewer, Distiller, and Wine Manufacturer"—Prof. Gardner gives some interesting facts regarding artificial drinks. Although he writes from an English point of view, it is not unlikely that his statements will have an adaptation otherwheres. Of beer he says that until recently malt, hops, and water were the only ingredients that entered into the composition of beer, but sugar and raw grain are also now used largely in place of malt, and occasionally other bitter flavouring materials are substituted for hops. The present proper definition of beer may be as follows: "A saccharine fluid flavoured with hops, or other aromatic bitters, which has been rendered alcoholic by fermentation." Aloes is now largely used to take the place of hops. It may leave the beer a lighter and more amber-like colour, but it is a very inferior substitute for hops. Its presence is readily detected by the taste.

The water used in the brewing of beer is known to have a marked influence on its quality. Any organic contamination in the water spoils the product. Hard water is preferred to soft water; the sulphates and salts of calcium and magnesium in the water tending to self-fining of the beer. The ales of Burton, England, get much of their celebrity from the water used in their brewing, which comes from wells sunk in the beds of red sandstone and gypsum that abound in the neighbourhood, and not from the river Trent, as popularly supposed.

Wines derive their distinctive peculiarities less from the original stock of the grape and from method of manufacture than from the climate and soil where the vines are grown. Wines so opposite in character as those of Burgundy, the Cape, and Spain are all made from the same stock of Burgundian grapes. To prevent viscidity or ropiness in wines while fermenting, grape stalks are added to the must, or tannic acid, oak bark, gall nuts, wood shavings, gypsum, and alum. When wine becomes bitter, isinglass, carbonate of lime, or slaked lime is added. To prevent acetous fermentation the wine must be fortified by alcohol.

The best whisky is made from malt. Inferior qualities are made from raw grain spirit prepared from barley, oats, rye, or rice, and the peculiar flavour admired by habitual users comes from the artificial addition of fusel oil, which is a narcotic poison.

The best brandy is distilled from white wines, but it loses strength with age, and with its strength goes its peculiar aroma. A sugar syrup with essence of cayenne and burnt sugar are used sometimes to "improve" weak brandy. Malt brandy is a spirit made from malt, potatoes, beets, or carrots.

Gin is ordinary grain spirit flavoured with oil of juniper, juniper berries, oil of turpentine, creosote, lemons, cardamoms, garlic, horseradish, caustic potash or sulphate of zinc.

Absinthe is an extract of wormwood mixed with sulphuric acid and coloured with spinach.

RECENT AMERICAN AND FOREIGN PATENTS.

Mr. John J. Myers, of Baltimore, Md., has obtained a patent for an improved dry gas meter, in which the stop plates are so constructed that it is impossible to pass a wire down the inlet passage and tamper with the works. With this meter persons with dishonest intent are prevented from disturbing the flow of gas, or its registry.

Mr. George W. Converse, of Spokane Falls, Washington Ter., has obtained a patent for an improvement in turbine water wheels of that class in which the water descends in an annulus through chutes which cause it to project obliquely against the sides of the bucket, on which it acts both by its impact and its weight, escaping from the bottom of the wheel in an annular stream.

Mr. Edgar T. Gordon, of New York city, is the patentee of an improved method of manufacturing turning lathes for light work. This consists in preparing the wearing portions of steel or iron, and completing the structure by casting the metal in and around these parts. This avoids all labour of tapping, drilling, keying, &c., and enables a very good machine to be made at little cost.

An improved instrument for *measuring distances*, called a geodometer, has been recently patented by Mr. Samuel Dewell, of River Sioux, Ind. A large wheel is journaled between two shafts and an odometer with dials and pointers is placed on the axle to record each revolution of the wheel, the rim of which is marked off into twenty-five equal parts, each division representing one link of a surveyor's chain. One of the several spokes in the wheel is painted a different colour from the rest, so that every revolution of the wheel is observed, and the distance travelled recorded. A novel arrangement is attached for calculating the distance across streams, &c., where the machine cannot be propelled. With the geodometer an inexperienced person can take measurements, and determine numbers of acres without much calculation, the distance travelled being automatically recorded by the odometer.

Mr. P. J. Leonard de Rache, of New York city, is the patentee of an improved fireproof ceiling. The ceiling is composed of tiles supported from the joists by hangers, and having facing tiles placed against the sides of the joists, and top tiles placed between the upper parts of the joists. The top tiles and the tops of the joists are covered by a layer of cement, rendering the ceiling secure against fire.

An improved *sash holder*, for holding and locking a sash in any desired position, is the subject of a patent granted to Mr. William Conner, of Missouri Valley, Iowa. Within the window casing is placed a wedge-shaped piece to which is attached a link movement. A handle is placed inside the room connecting with the link attachment. By operating this handle the wedge is brought more or less forcibly against the edge of the sash, holding the window partially open or closed as desired.

Mr. Michael Hannan, of New York city, has obtained a patent for an improved snow melting apparatus intended to facilitate the removal of snow from streets. This consists in a tank open at the top, to that the snow may be readily shovelled into it. A cylindrical furnace is placed within the tank. The snow as it falls upon the heated wall over the furnace flues is immediately melted, and the water flowing into a reservoir may be used for clearing away any remaining snow upon the street and in the gutter.

Gilchrist Engineering Scholarships.—The Gilchrist Engineering Entrance Scholarship at University College, London, will be open to competition at the end of September. The conditions of examination are this year somewhat altered in a direction which places the Scholarship better within the reach of those for whose benefit it was founded. The detailed regulations can be obtained on application to the Secretary of University College; the following is a summary of them:—Candidates must be under nineteen years of age, and must send in notice to compete by the 23rd of September. The subjects of examination are—1. Elementary Mathematics; and 2. Any two or more of the following five subjects: Mechanics, Mechanical Drawing, Essay on one of three given subjects connected with Mechanics or Engineering, French or German, the Use of Tools, either carpenters' tools, or the lathe (wood or metal), or the file. The Scholarship is of the value of £35 per annum, and is tenable for two years. There is also at University College a Senior Engineering Scholarship, awarded at the close of the session of the value of £80.

Prehistoric Man.—Professor Marsh contributes a paper to the *American Journal of Science* for August in regard to the reported finding of human footprints in sandstone near Carson, Nevada. He says that many different kinds of tracks were found, some of which were made by an animal allied to the elephant; some resembled those of the horse and the deer; others were apparently made by a wolf. There were also tracks made by large birds. The supposed human footprints are in six series, each with alternate right and left tracks. The stride is from two and one-half to over three feet in extent. The individual footprints are from eighteen to twenty inches in length, and about eight inches wide. The distance between the line of right hand and left hand tracks, or the straddle, is eighteen to nineteen inches. The size of these footprints, and especially the width between the right and left series, are strong evidence that they were not made by men, as has been so generally supposed. A more probable explanation is that the impressions are the tracks of a large sloth, either *Mylodon* or *Morotherium*, remains of which have been found in essentially the same horizon.

Submarine Exploration.—Signor Toselli is reported to have invented an apparatus for exploring the depths of the ocean without danger or inconvenience. It is about 25 feet in height, and constructed of steel plate with gun-metal castings. It is calculated to resist a pressure of 180 lbs. to the square inch, so as to be able to attain a depth of 65 fathoms. The internal space is divided into three compartments—at the bottom, a chamber capable of being enlarged or contracted by a flexible diaphragm, so as to increase or diminish the volume of water displaced, and thus permit of rising or sinking; a room capable of holding eight explorers, occupying the central portion of the spheroid, and provided with lenses, so as to permit of looking out; and the upper space, reserved for those entrusted with manœuvring the vessel. A powerful electric lamp is to shed its rays all round the apparatus for a considerable area, and telegraphic and telephonic wires will place those in the vessel in communication with the steamer from which it is suspended,

Tanning Textile Fabrics.—M. Piron, a Belgian has invented a process for tanning textile fabrics which renders them waterproof, and at the same time it is said, proof against decay, while their suppleness is not diminished, and their weight not appreciably increased. Arguing from the high state of preservation in which the bands which surround the heads of Egyptian mummies are found to this day. and which ere impregnated with a kind of resin, M Piron had recourse to the substance extracted from birch bark, and which is now used to perfume Russia leather. When the fine white bark of the birch tree is distilled, it yields a light oil, nearly a fourth part of which consists of the special phenol, or carbolic acid, which gives the well-known odour to Russia leather. It is now found that the residue, or green tar of the birch, which is obtained from *Kostroma*, yields neither acid nor alkaloid, and it forms, with alcohol, a solution of great fluidity, which, however, when once dried, is unacted upon by alcohol. It is this substance, which will unite with the most brilliant colours that is used by M. Piron for treating textile fabrics. Not only does it fill the capillary vessels, but it also coats them with a vernish of great elasticity which is unattackable by acids and sea-water, whil it also stands great changes of temperature. The aromatic odour of articles thus treated drives away insects; there is no space for microscopic vegetation, and neither air nor water can penetrate into the tissues. This process is applicable to all vegetable products, such as sailcloth, cordage, blinds, and awnings.

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